

FABRICATION OF AN ALUMINUM BASED HOT ELECTRON MIXER FOR TERAHERTZ APPLICATIONS

P. M. Echternach, H.G. LeDuc, A. Skalare and W.R. McGrath
Center for Space Microelectronics Technology, Jet Propulsion Laboratory,
California Institute of Technology, Pasadena, CA, 91109-8099

Aluminum based diffusion cooled hot electron bolometers (HEB) mixers, predicted to have better noise, bandwidth and to require less LO power than Nb based diffusion cooled HEBs, have been fabricated. Preliminary DC tests were performed. The bolometer elements consisted of short (0.1 to 0.3 μm), narrow (0.08 to 0.15 μm) and thin (11 nm) aluminum wires connected to large contact pads consisting of a novel trilayer Al/Ti/Au. The patterns were defined by electron beam lithography and the metal deposition involved a double angle process, the Aluminum wires being deposited straight on and the pads being deposited at a 45 degree angle without breaking vacuum. The Al/Ti/Au trilayer was developed to provide a way of making contact between the aluminum wire and the gold antenna. The Titanium layer acts as a diffusion barrier to avoid damage of the Aluminum contact and bolometer wire and to lower the transition temperature of the pads to below that of the bolometer wire. The Au layer avoids the formation of an oxide on the Ti layer and provides good electrical contact to the IF/antenna structure. The resistance of the bolometers as a function of temperature was measured. It is clear that below the transition temperature of the wire (1.8K) but above the transition temperature of the contact pads (0.6K), the proximity effect drives most of the bolometer wire normal, causing a very broad transition. This effect should not affect the performance of the bolometers since they will be operated at a temperature below the TC of the pads. This is evident from the IV characteristics measured at 0.3K. RF characterization tests will begin shortly.

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